

REMARKS

Applicant respectfully requests reconsideration of the rejection in the instant application. Claims 1 and 26 have been amended as instructed by the Examiner and claim 20 has been canceled. Upon entry of the above amendment, claims 1, 3, 5-19, and 21-28 remain pending in the present application. Applicant has reviewed the prior art made of record and does not believe that the prior art affects the patentability of all pending claims 1, 3, 5-19, and 21-28.

Rejection of Claims 1, 3, and 5-28

Claims 1, 3, 5-7, and 9-28 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Semiconductor Energy Lab (SEL) (JP 05-097583) in view of U.S. Patent No. 5,236,545 to Pryor *et al.* ("Pryor") and either U.S. Patent No. 5,451,260 to Versteeg *et al.* ("Versteeg") or U.S. Patent No. 5,874,014 to Robson *et al.* ("Robson"). Claims 20, 22, 23, 26, and 27 have been rejected under 35 U.S.C. §103(a) as being unpatentable over SEL in view of Pryor and Versteeg and further in view of Robson. Claim 8 has been rejected under 35 U.S.C. §103(a) as being unpatentable over SEL in view of Pryor and either Versteeg or Robson and in further view of Patent No. 5,381,755 to Glesener *et al.* ("Glesener"). Applicant respectfully urges that the rejections have been overcome by the following arguments.

In the Claims

Claims 1 and 26 have been amended as suggested by the Examiner to overcome the 35 U.S.C. §112, second paragraph rejections. Therefore, the claim rejections should be withdrawn.

Claims 1, 13, 21, and 25

Applicant submits that the rejection of claims 1, 13, 21, and 25 under 35 U.S.C. §103 should be withdrawn because SEL in view of Pryor, Versteeg, and Robson, individually or in combination, does not disclose, teach, or suggest all of the elements of claims 1, 13, 21, and 25.

SEL teaches the use of a magnetic field microwave plasma CVD system ([11]) that cannot use hydrogen ([10]) and operates at pressures less than 1 Torr. Indeed, SEL teaches the use of a very strong magnetic field of up to 2000 Gauss, “the maximum magnetic-field-intensity” ([13]) that the magnetic field microwave plasma CVD system can produce. SEL attempted to produce diamond without use of the magnetic field, which resulted in an “amorphous-like carbon film [that] is remarkable” ([22]). SEL indicates that the material produced without using a magnetic field was unlike the diamond film produced using a strong magnetic field microwave plasma CVD system ([19]), as evidenced by a minor peak amidst a much larger carbon peak in the spectrum that could be attributed to diamond. In addition, the non-magnetic deposition process produced, at best, a low quality non-uniform diamond film (*i.e.*, dispersion thickness of about 50% ([21])).

Furthermore, the magnetic field microwave plasma CVD system of SEL does not operate at pressures above 1 Torr due to excessively high collision frequency between electrons in the plasma with the vapor molecules. The high frequency collisions between the electrons and vapor molecules reduce the mean-free-path of electrons, resulting in the failure of a magnetic field to enhance the absorption of microwave power by the electrons. In addition, the magnetic field microwave plasma CVD system of SEL does not operate at pressures above 1 Torr because the system uses a mass flow controller, which limits the flow into the system.

It is well settled at law that only prior art references from “analogous art” should be used as prior art. References are considered to be “analogous art” when “a person of ordinary skill would reasonably have consulted those references and applied their teachings in seeking a solution to the problem that the inventor was attempting to solve.” *Heidelberger Druckmaschinen v. Hantscho Commercial Prods., Inc.*, 21 F.3d 1068, 1071 (Fed. Cir. 1994).

Applicant’s invention, as claimed in claims 1, 13, 21 and 25, is a method that uses a plasma CVD system to produce diamond. In contrast and as discussed above, SEL uses a magnetic field microwave plasma CVD system to produce diamond. Methods of using plasma CVD system and magnetic field microwave plasma CVD system operate under very different conditions (*i.e.*, magnetic field vs. no magnetic field, and pressures below 1 Torr vs. pressures well above 1 Torr (Examples 1-8 (20-80 Torr) in the Applicant’s patent application). In addition, the equipment required to produce the magnetic field used by SEL is expensive and complicated. Therefore, although both techniques are CVD techniques, the SEL reference is not analogous art, because a person of ordinary skill in the art would not consult a reference discussing magnetic field microwave plasma CVD and apply its teachings to the problem the Applicant has solved by using a non-magnetic field plasma CVD system. SEL even admits this by stating that the spectrum produced without the use of a strong magnetic field is unlike the spectrum produced using the magnetic field ([¶19]).

Pryor does not cure the deficiencies of SEL. Pryor teaches the use and significance of hydrogen as a carrier gas to the deposition of diamond materials (Fig. 1, Col. 5, lines 35-49, Col. 7, lines 47-64). Prior processes, including Pryor, were dependent upon hydrogen chemistry to produce a hydrogen terminated carbon layer. Without the use of hydrogen, a surface of carbon-

carbon bonds is formed, which is not conducive to CVD diamond growth. (Col. 5, lines 35-49, Col. 7, lines 47-64).

As acknowledged by the Examiner in the most recent Office Action, the invention, as claimed in claims 1, 13, 21, and 25, does not use a carrier gas. In contrast, Pryor uses a carrier gas, hydrogen, and indicates it is a necessary component to produce diamond. (Col. 5, lines 35-49, Col. 7, lines 47-64). Therefore, although both techniques are CVD techniques, one skilled in the art would not consider Pryor analogous art, because a person of ordinary skill in the art would not have consulted Pryor and applied its teachings to the problem the Applicant has solved using a plasma CVD system because the chemistry is extremely different. In addition, the claimed methods are also safer, more economical, and produce a higher quality diamond than the cited prior art. In particular, the equipment required to handle compressed gases are more expensive (*i.e.*, gas manifolds and mass flow controllers). In addition, the use of hydrogen can be unsafe, since hydrogen is explosive.

Furthermore, one of ordinary skill in the art would not consider SEL and Pryor analogous art with each other, and thus are not properly combinable. Although both prior art references are in the broad field of CVD, SEL is in the field of magnetic field microwave plasma CVD, while Pryor is in the field of non-magnetic microwave plasma CVD. As discussed above, magnetic field microwave plasma CVD uses a magnetic field in conjunction with the microwave plasma CVD to form diamond, which restricts the pressure range in which the magnetic field microwave CVD system can operate. In addition, the magnetic field microwave CVD system of SEL cannot use a reactant gas. In contrast, Pryor must use a reactant gas to form diamond. In addition, Pryor operates at a higher pressure to form diamond. Therefore, modifying SEL in view Pryor would render the method inoperative for its intended purpose. *In re Spinnoble*, 405 F.2d 578 (CCPA

1969). Applicant respectfully submits that simply because the invention taught by SEL is applicable in the field of CVD, does not mean that the teachings of SEL and Pryor are analogous art.

As stated by the Federal Circuit, that “[i]t is impermissible, ... to simply engage in hindsight reconstruction of the claimed invention, using the applicant’s structure as a template and selecting elements from references to fill the gaps.” *In re Gorman*, 933 F.2d 982, 987, (Fed. Cir. 1991). In this regard, “[o]bviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined *only* if there is some suggestion or incentive to do so.” *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577 (Fed. Cir. 1984).

Indeed, it is also well settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. *W. L. Gore & Assocs., Inc. v. Garlock Thomas, Inc.*, 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art... Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added*) *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988). In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to

suggest both the combination of elements and the structure resulting from the combination.

Stiftung v. Renishaw PLC, 945 F.2d 1173 (Fed. Cir. 1991).

In addition, the Board of Patent Appeals and Interferences' rejection of a need for any specific hint or suggestion in the art to combine references was recently held to be legal error. *In re Lee*, 277 F.3d 1338 (Fed. Cir. 2002). The Examiner has not pointed to any place in SEL, Pryor, Versteeg, or Robson that hint or suggest the combination of these references. In fact, SEL and Pryor teach away from combining one another. SEL teaches the use of a magnetic field microwave plasma CVD system, while Pryor teaches the use of a microwave plasma CVD system. In addition, SEL teaches that it cannot use a carrier gas (hydrogen) ([¶10]) or operate at pressures above 1 Torr ([¶13]), while the chemistry of Pryor depends upon the use of a carrier gas (hydrogen) (Col. 5, lines 35-49, Col. 7, lines 47-64) and operates at pressures much greater than 1 Torr (Col. 9, line 46-47). Even if one were to select portions of SEL and combine them with Pryor, the method would only be useful to grow carbon graphite. Thus, modifying SEL in view Pryor would render the method inoperative for its intended purpose. *In re Spinnoble*, 405 F.2d 578 (CCPA 1969). For at least these reasons, "a person of ordinary skill in the art, upon reading the references, would be discouraged from following the path set forth in these references...". *In re Gurley*, 27 F.3d 551 (Fed. Cir. 1994).

In addition, Versteeg, Robson, and Glesener do not cure the deficiencies of SEL and Pryor. Therefore, claims 1, 13, 21, and 25 are in condition for allowance.

Applicant would like to note that the Applicant would be amenable to amending claims 1, 13, 21, and 25 to include a pressure limitation (see Examples 1-8 in the application) if the Examiner believes this would place the application in condition for allowance. For example, claim 1 can be amended in the following manner: "introducing, in the absence of a gas stream, a

liquid precursor substantially free of water and containing methanol and at least one carbon and oxygen containing compound having a carbon to oxygen ratio greater than one into an inlet of the reaction chamber in a pressure range from about 20 to 80 Torr". In addition, the Applicant would be amendable to amending claims 1, 13, 21, and 25 to include a weight percent limitation for methanol (see Examples 1-8 in the application) if the Examiner believes this would place the application in condition for allowance. For example, claim 1 can be amended in the following manner: "introducing, in the absence of a gas stream, a liquid precursor substantially free of water and containing methanol and at least one carbon and oxygen containing compound having a carbon to oxygen ratio greater than one into an inlet of the reaction chamber, wherein the methanol is in the range from about 50 weight percent to about 99.5 weight percent."

Claims 3, 5-12, and 19

Applicant respectfully submits that pending dependent claims 3, 5-12, and 19 include every feature of independent claim 1 and that SEL in view of Pryor, Versteeg, and Robson, individually or in combination, fail to disclose, teach, or suggest at least the features of claim 1 highlighted hereinabove. In addition, Applicant respectfully submits that pending claim 8 includes every feature of independent claim 1 and that SEL in view of Pryor, Versteeg, Robson, and Glesener, individually or in combination, fail to disclose, teach, or suggest at least the feature of claim 1 highlighted hereinabove. Thus, pending dependent claims 3, 5-12, and 19 are allowable over the prior art of record. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claims 14-18

Applicant respectfully submits that pending dependent claims 14-18 include every feature of independent claim 13 and that SEL in view of Pryor, Versteeg, and Robson, individually or in combination fail to disclose, teach, or suggest at least the features of claim 13 highlighted hereinabove. Thus, pending dependent claims 14-18 are allowable over the prior art of record. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claims 22-24

Applicant respectfully submits that pending dependent claims 22-24 include every feature of independent claim 21 and that SEL in view of Pryor, Versteeg, and Robson, individually or in combination, fail to disclose, teach, or suggest at least the features of claim 21 highlighted hereinabove. Thus, pending dependent claims 22-24 are allowable over the prior art of record. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

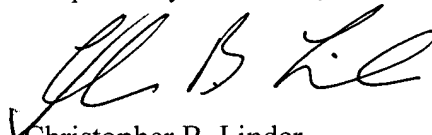
Claims 26-28

Applicant respectfully submits that pending dependent claims 26-28 include every feature of independent claim 25 and that SEL in view of Pryor, Versteeg, and Robson, individually or in combination fail to disclose, teach, or suggest at least the features of claim 25 highlighted hereinabove. Thus, pending dependent claims 26-28 are allowable over the prior art of record. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

CONCLUSION

It is respectfully submitted that claims 1, 3, 5-19, and 21-28 of the present application are in a condition for allowance and an early notice to such effect is earnestly solicited. If the Examiner believes that unresolved issues remain, it is requested that the Examiner contact the undersigned counsel for Applicant by telephone in order to expedite resolution and disposal of the issues.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "C. B. Linder", with a checkmark to the left of the first name.

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ANNOTATED VERSION OF MODIFIED CLAIMS TO SHOW CHANGES MADE

The following is a marked up version of the amended claims. Amend the following claims by adding the language that is underlined (“___”) and by deleting the language that is enclosed within brackets (“[]”):

1. (Fourth Amendment) A method of forming diamond crystals or a diamond film comprising disposing a substrate in a reaction chamber;
introducing, in the absence of a gas stream, a liquid precursor substantially free of water and containing methanol and at least one carbon and oxygen containing compound having a carbon to oxygen ratio greater than one into an inlet of the reaction chamber;
vaporizing the liquid precursor; and
subjecting the vaporized precursor, in the absence of a carrier gas, to a plasma under conditions effective to disassociate the vaporized precursor and promote diamond growth on the substrate.
26. (First Amendment) The method of claim 25, wherein [promoting diamond growth] producing diamond crystals or diamond films includes:
promoting diamond growth, in the absence of a carrier gas, at a rate between about 1 micrometer and 2.7 micrometers per hour.